

WE CLAIM:

1. A method for testing a data storage medium for defects, the method comprising:
writing a data pattern to at least one predetermined region of the storage medium;
reading back the written data pattern;
5 comparing the data pattern written to the data pattern read back and identifying any error in
the data;
if an error in the data was identified, then:
identifying a defective region of the storage medium;
reallocating a new region of the storage medium;
10 initializing the reallocated new region for access; and
replacing the defective region with the reallocated region before any further
degradation occurs.
2. The method of Claim 1, further comprising determining whether the predetermined region
contains user data, retrieving the user data and storing it to a temporary location before testing the
predetermined region, and writing the saved user data back to the predetermined region if no error
is detected.
3. The method of Claim 1, further comprising reporting errors to a storage device administrator.
- 20 4. The method of Claim 1, wherein the method is performed as a background task by a
processor.
5. The method of Claim 1, wherein the method is executed when the frequency of storage
25 accesses is within a predetermined range.
6. The method of Claim 1, wherein the writing of a data pattern comprises writing a stress
pattern to the region.

7. The method of Claim 2, wherein the determining whether the predetermined region contains data is performed by examining a sector written indicator.

8. The method of Claim 2, wherein the determining whether the predetermined region contains data is performed by examining a sector stripe written indicator.

9. The method of Claim 2, wherein the determining whether the predetermined region contains data is performed by examining a stripe written indicator.

10. A method of testing a data storage medium for errors in a region of a storage device, the method comprising:

performing nondestructive testing of the region by reading data from a first region of a storage device and writing the data to a temporary location if the data is to be saved;

writing the data read from the first region back to the first region; and

if an error is detected either during the reading or during the writing, reallocating a second region, initializing the second region and replacing the first region with the second region.

11. The method of Claim 10, wherein the method is performed on the first region if the first region is identified as a written region by a sector written indicator.

12. The method of Claim 10, wherein the method is performed on the first region if the first region is identified as a written region by a sector stripe written indicator.

13. The method of Claim 10, wherein the method is performed on the first region if the first region is identified as a written region by a stripe written indicator.

14. The method of Claim 10, further comprising reporting detected errors to a storage device administrator.

15. The method of Claim 10, wherein the method is performed as a background task by a processor.

16. The method of Claim 10, wherein the method is executed when the frequency of storage accesses is within a predetermined range.

17. A method for testing a data storage medium for defects, the method comprising:
determining when a usage level of the storage medium is within a range of usage level for which background processing is permitted, and when the usage level is within the permitted range performing as a background process: (i) writing a stress data pattern to at least one predetermined region of the storage medium; and (ii) reading back the written data pattern;

comparing the data pattern written to the data pattern read back and identifying and reporting any error;

if an error was reported, then :

identifying a defective region;

reallocating a new region;

initializing the reallocated region for access; and

replacing the defective region with the reallocated region before any further degradation occurs.

18. The method of Claim 17, further comprising reporting the defective region.

19. The method of Claim 17, wherein the determining whether the predetermined region contains data is performed by examining a sector written indicator.

20. The method of Claim 17, wherein the determining whether the predetermined region contains data is performed by examining a sector stripe written indicator.

21. The method of Claim 17, wherein the determining whether the predetermined region contains data is performed by examining a stripe written indicator.

22. A method of testing a data storage medium for errors in a region of a storage device, the region associated with an indicator that indicates whether a host computer has written data to the region, the method comprising :

determining that the host computer has written data to the region by examining the indicator;

as a background process, performing nondestructive testing of the region by reading data from a first region of a storage device and writing the data to a temporary location if the data is to be saved;

as a background process, writing the data read from the first region back to the first region;

if an error is detected either during the reading or during the writing, reallocating a second region, initializing the second region and replacing the first region with the second region.

23. The method of Claim 22, wherein the method is performed on the first region if the first region is a sector on a disk that is identified as a written region by a sector written indicator.

24. The method of Claim 22, wherein the method is performed on the first region if the first region is a plurality of sectors contained on multiple disks and is identified as a written region by a sector stripe written indicator.

25. The method of Claim 22, wherein the method is performed on the first region if the first region is a plurality of sectors on a single disk that is identified as a written region by a stripe written indicator.

26. The method of Claim 22, further comprising reporting the defective region.

27. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs the computer system or a controller coupled thereto to test a storage medium for defects,

5 the program module including instructions for:

writing a data pattern to at least one predetermined region of the storage medium;

reading back the written data pattern;

comparing the data pattern written to the data pattern read back and identifying and reporting any error;

10 if an error was reported, then :

identifying a defective region;

reallocating a new region;

initializing the reallocated region for access; and

15 replacing the defective region with the reallocated region before any further degradation occurs.

28. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs the computer system or a controller coupled thereto to test a storage medium for defects,

20 the program module including instructions for:

performing nondestructive testing of the region by reading data from a first region of a storage device and writing the data to a temporary location if the data is to be saved;

writing the data read from the first region back to the first region;

25 if an error is detected either during the step of reading or during the step of writing, reallocating a second region, initializing the second region and replacing the first region with the second region.

29. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs the computer system or a controller coupled thereto to test a storage medium for defects,

5 the program module including instructions for:

determining when a usage level of the storage medium is sufficiently low to allow effective background processing;

as a background process, writing a stress data pattern to at least one predetermined region of the storage medium;

10 as a background process, reading back the written data pattern;

comparing the data pattern written to the data pattern read back and identifying and reporting any error;

if an error was reported, performing the steps of:

identifying a defective region;

15 reallocating a new region;

initializing the reallocated region for access; and

replacing the defective region with the reallocated region before any further degradation occurs.

20 30. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs the computer system or a controller coupled thereto to test a data storage medium for errors in a region of a storage device, the region associated with an indicator that indicates whether
25 a host computer has written data to the region, the program module including instructions for:

determining that the host computer has written data to the region by examining the indicator;

as a background process, performing nondestructive testing of the region by reading data from a first region of a storage device and writing the data to a temporary location if the data is to be saved;

as a background process, writing the data read from the first region back to the first region;

5 if an error is detected either during the step of reading or during the step of writing, reallocating a second region, initializing the second region and replacing the first region with the second region.

31. An apparatus for storing data, the apparatus in communication with a host computer and
10 capable of having data written to the apparatus and data read from the apparatus by the host computer, the apparatus comprising:

a data storage medium organized into discrete regions;

a storage medium controller that reads data from and writes data to the storage medium;

an indicator that a discrete region has been written to by the host computer; and

15 a media surface scanner that performs non-destructive testing by writing a data pattern to at least one predetermined region of the storage medium;

reading back the written data pattern;

comparing the data pattern written to the data pattern read back and identifying and reporting
any error;

20 if an error was reported:

identifying a defective region;

reallocating a new region;

initializing the reallocated region for access; and

25 replacing the defective region with the reallocated region before any further degradation occurs.

32. The apparatus of Claim 31, wherein the storage medium comprises a magnetic storage disk.

33. The apparatus of Claim 31, wherein the storage medium comprises an array of magnetic storage disks.

34. The apparatus of Claim 31, wherein the storage medium comprises an optical storage disk.

35. The apparatus of Claim 31, wherein the storage medium comprises an array of optical storage disks.

36. The apparatus of Claim 31, wherein the media surface scanner is stored on the host computer.

37. The apparatus of Claim 31, wherein the media surface scanner is stored on the storage medium controller.

38. The apparatus of Claim 32, wherein the storage medium is divided into sectors, and the indicator indicates whether at least one sector has been written to by the host computer.

39. The apparatus of Claim 33, wherein the disks in the array are divided into sectors, and the indicator indicates whether at least one sector has been written to by the host computer.

40. The apparatus of Claim 33, wherein the array of disks comprises a redundant array of independent disks.

41. A method for testing a data storage medium for defects, the method comprising:

as a background procedure by a processor acting as a controller when processor utilization is below a predetermined threshold : (a) writing a stress data pattern to at least one predetermined region of the storage medium; (b) reading back the written data pattern; (c) comparing the data pattern written to the data pattern read back and identifying any error in the data; and (d) if an error in the data was identified, then: (i) identifying a defective region of the storage medium; (ii)

reallocating a new region of the storage medium; (iii) initializing the reallocated new region for access; and (iv) replacing the defective region with the reallocated region before any further degradation occurs; and

determining whether the predetermined region contains user data by examining at least one
5 of a sector written indicator or a sector stripe written indicator, and retrieving the user data and storing it to a temporary location before testing the predetermined region, and writing the saved user data back to the predetermined region if no error is detected.

42. A RAID controller, operatively connected to a host computer and a plurality of magnetic
10 storage disks, wherein the storage disks are divided into sectors, such that the RAID controller enables the host computer to read and write data to the storage disks, the RAID controller comprises a media surface scanner that operates as a background process to perform nondestructive write testing to the sectors, and, upon finding defects in the sectors, reallocating sectors to replace the sectors having defects, and, when a sufficient number of defects has been detected, reports the
15 defective sectors to a host computer.